

BS EN 62264-5:2012



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Enterprise system integration

Part 5: Business to manufacturing
transactions

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

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30 April 2012	This corrigendum renumbers BS IEC 62264-5:2011 as BS EN 62264-5:2012. Annex ZA has been inserted.

**Enterprise system integration -
Part 5: Business to manufacturing transactions
(IEC 62264-5:2011)**

Intégration du système de commande
d'entreprise -
Partie 5: Transactions entre systèmes de
gestion de commande d'entreprise et
systèmes de fabrication
(CEI 62264-5:2011)

Integration von Unternehmensführungs-
und Leitsystemen -
Teil 5: Transaktionen zwischen
Geschäftsabläufen und
Produktionssteuerung
(IEC 62264-5:2011)

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Foreword

The text of document 65E/100/CDV, future edition 1 of IEC 62264-5, prepared by SC 65E, "Devices and integration in enterprise systems", of IEC TC 65, "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62264-5:2012.

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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-02-03

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Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62264-1	-	Enterprise-control system integration - Part 1: Models and terminology	EN 62264-1	-
IEC 62264-2	-	Enterprise-control system integration - Part 2: Object model attributes	EN 62264-2	-
IEC 62264-3	-	Enterprise-control system integration - Part 3 Activity models of manufacturing operations management	EN 62264-3	-

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INTRODUCTION

This part of IEC 62264 is based on the use of IEC 62264 abstract models previously defined in IEC 62264-1 and IEC 62264-2 combined with verbs to define a transaction model for information exchange. It is recognized that other non-IEC 62264-5 transaction protocols are possible and are not deemed invalid as a result of this standard. Transactions occur at all levels within the enterprise and between enterprise partners, and are related to both required and actual activities, but the focus of this part of IEC 62264 is the interface between enterprise/business systems and manufacturing systems.

This standard defines business-to-manufacturing transactions and manufacturing-to-business transactions that may be used in relation to the objects that are exchanged between Level 4 and Level 3, as defined in the object models of IEC 62264-1 and IEC 62264-2. Models are introduced which provide descriptions of the transactions and explanations of the required transaction processing behaviour.

Technology specific implementations to provide this behaviour are not defined in this standard. This part of IEC 62264 has the intent of providing insight into the level of work required to construct transactional exchanges.

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 5: Business to manufacturing transactions

1 Scope

This part of IEC 62264 defines transactions in terms of information exchanges between applications performing business and manufacturing activities associated with Levels 3 and 4. The exchanges are intended to enable information collection, retrieval, transfer and storage in support of Enterprise-Control system integration. This part of IEC 62264 is consistent with the IEC 62264-1 models and terminology and IEC 62264-2 object model attributes. This standard also defines transactions that specify how to exchange the objects defined in IEC 62264-1, Clause 7, IEC 62264-2 and this standard. Other uses of the transaction model are not defined in this part.

The models covered in this standard are: Personnel Model, Equipment Model, Maintenance Model, Material Model, Process Segment Model, Production Capability Model, Product Definition Model, Production Schedule Model, and Production Performance Model.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62264-1, *Enterprise-control system integration – Part 1: Models and terminology*

IEC 62264-2, *Enterprise-control system integration – Part 2: Object model attributes*

IEC 62264-3, *Enterprise-control system integration – Part 3: Activity models of manufacturing operations management*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply. Terms, definitions and concepts expressed in IEC 62264-1, IEC 62264-2 and IEC 62264-3 apply, except where differences are explicitly stated in this document.

3.1.1

application

ordered set of physical and virtual processes, performed by a set of resources that conduct a set of transactions intended to accomplish a definite objective; information provider or information user performing the activity that is involved in a transaction

3.1.2

identifier

ID

information to identify an object or a property of an object

3.1.3

message

structured information unit conveyed in a one-way transfer of data between one sending application to one or more receiving applications

3.1.4

noun

one of two parts in the content of a message, the one that represents one or more objects, as defined in IEC 62264-1 and IEC 62264-2 object models

3.1.5

transaction

sequence of related messages that are exchanged among applications performing Level 3 or Level 4 activities

3.1.6

verb

one of two parts in the content of a message, the one that defines the action to be performed, or the response to a request

3.1.7

wildcard

information to identify a collection of objects or properties of objects

3.2 Abbreviations

OAGIS – Open Applications Group Interface Standard

SYNC – Synchronized data

4 Transaction messages and verbs

4.1 General

This clause defines a common set of transactions, messages and verbs that shall be used between Level 4 and Level 3 applications to exchange the data defined in the object models of IEC 62264-1, Clause 7 and IEC 62264-2.

A transaction shall consist of a sequence of messages, where each message shall have a structure as defined in 4.2.

Messages shall contain both a verb area and a noun area. Information conveyed in a message shall be contained in the noun area of a message while the actions associated with information shall be contained in the verb area.

The role of an application initiating a transaction shall determine the set of verbs to be used in conducting the transaction. These transaction models are described in 4.2.

Three different transaction models are defined.

- a) A PULL transaction model where a user of data requests the data from a provider of the data.
- b) A PUSH model where a provider of data requests an action (processing, changing or cancelling) on the data by another user.
- c) A PUBLISH transaction model where the owner of data publishes it to users (subscribers) of the data.

NOTE 1 The phrase “owner of data” is used to identify the application that has responsibility for enforcing the consistency of data.

NOTE 2 This standard does not address the case where there may be multiple systems that can act as the owner of data. In these situations, configurations should be set up so that one master owner of the data should be designated, with other systems performing the role of data users.

4.2 Transaction models

There are three classes of actions provided by the verb set: query/reporting, transaction processing, and data synchronization. These are defined by three different transaction models.

- a) A PULL model where a user of data requests information from an information provider. This model is used for query/reporting.

Information provider applications listen for GET messages and respond with SHOW messages to complete the transaction.

Information user applications send GET messages.

- 1) Requests for information are sent through GET messages.
- 2) A GET message describes the scope of the requested information.
- 3) A SHOW message returns the information.

- b) A PUSH model where a sender of information sends new or changed information to the receiver to process requests. This model is used for transaction processing.

Receiver applications listen for PROCESS, CHANGE or CANCEL messages.

Sender applications send PROCESS, CHANGE and CANCEL messages.

- 1) New information is pushed to the receiver through a PROCESS message. Responses may be returned to the sender through an ACKNOWLEDGE message.
- 2) Changes to information are pushed to the receiver through a CHANGE message. Responses may be returned to the sender through a RESPOND message.
- 3) Information to be removed is pushed to the receiver through a CANCEL message.

- c) A PUBLISH model where the provider of data publishes it to users (subscribers) of the data. This model is used for data synchronization.

Subscriber applications receive SYNC messages.

Publisher applications send SYNC messages.

- 1) The publisher sends SYNC messages containing new, changed or deleted information to subscribers.
- 2) A subscriber receives SYNC messages containing new, changed or deleted information.

The timing of the publication and scope of the published information is not defined in a message. It is determined by an out-of-band agreement between the publisher and subscriber, therefore there is no SUBSCRIBE message defined in this standard.

Example: An out-of-band agreement means that the agreement is not defined in the transaction protocol. For example: an agreement between a publisher and subscriber may be set up through configuration parameters in the applications, or an agreement may be set up dynamically through a web service agreement, or an agreement may be set up through a third party application.

A single application may support one or more transaction models and the application may take on multiple roles (sender, receiver, provider and user).

NOTE 1 The transactions are based on the assumption that the exchanged information (noun) is contained in a message of some form. The exact form of the messages is not defined in this standard; for example, the messages could be tab delimited files, XML files, electronic mail messages, or data in a named pipe. The exact form of the transport mechanism for the sending, receiving, listening and publishing of messages is not defined in this standard.

NOTE 2 The transaction message models do not imply any specific architecture or mechanism for transporting the messages.

The transactions assume the ability to send an empty or nearly empty message that identifies either a specific object (typically by ID), a list of specific objects (by a list of IDs), or a class of objects (by wildcard or property value definition).

Figure 1 illustrates the exchange of messages in a typical transaction, where a message is sent from the user of information with an identification of an object (GET Equipment), and a message is returned from the information provider with the object's information (SHOW Equipment).

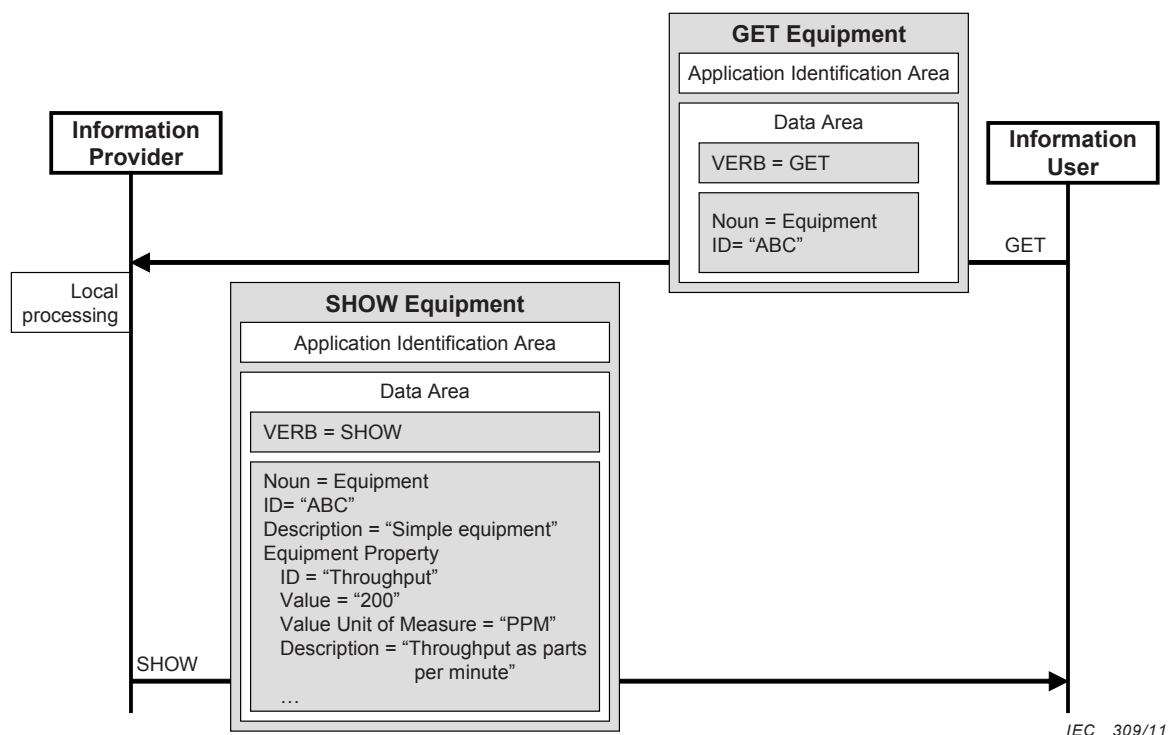


Figure 1 – Typical exchanged messages in a transaction

4.3 Message structure

4.3.1 General structure

Every message shall contain all the information required to identify the source of the message and the type of the message. There shall be two main areas in a message, as shown in Figure 2, an *application identification area* and a *data area*. Within the *data area* there shall be a *verb area* and a *noun area*.

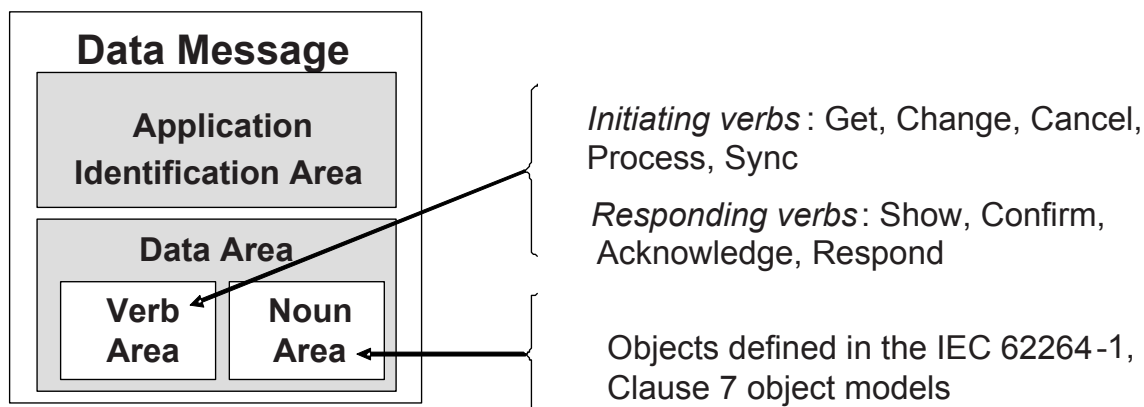


Figure 2 – Typical exchanged data set

4.3.2 Application identification area

The application identification area shall carry information that a receiving application uses to handle a message. The application identification area is used for the application layer of communication, such as indicating a required confirmation of message processing. This information typically includes the electronic address of the sender, an indication of the confirmation requirement, and the date and time the message was created. The application identification area may also include other information required for identification and authentication of the messages. Figure 3 illustrates a typical layout for an application identification area.

NOTE See the OAGIS (Open Applications Group Integration Specification) 9.0 specification for a format for the application identification area. The data exchange model defined in this standard is consistent with the OAGIS specification; such that an implementation of OAGIS, using the objects defined in IEC 62264-1 and IEC 62264-2, can conform to this standard

Dates and times shall include time zone information in order to unambiguously identify times, such as coordinated universal time or ISO 8601 CE (Common Era) calendar extended format.

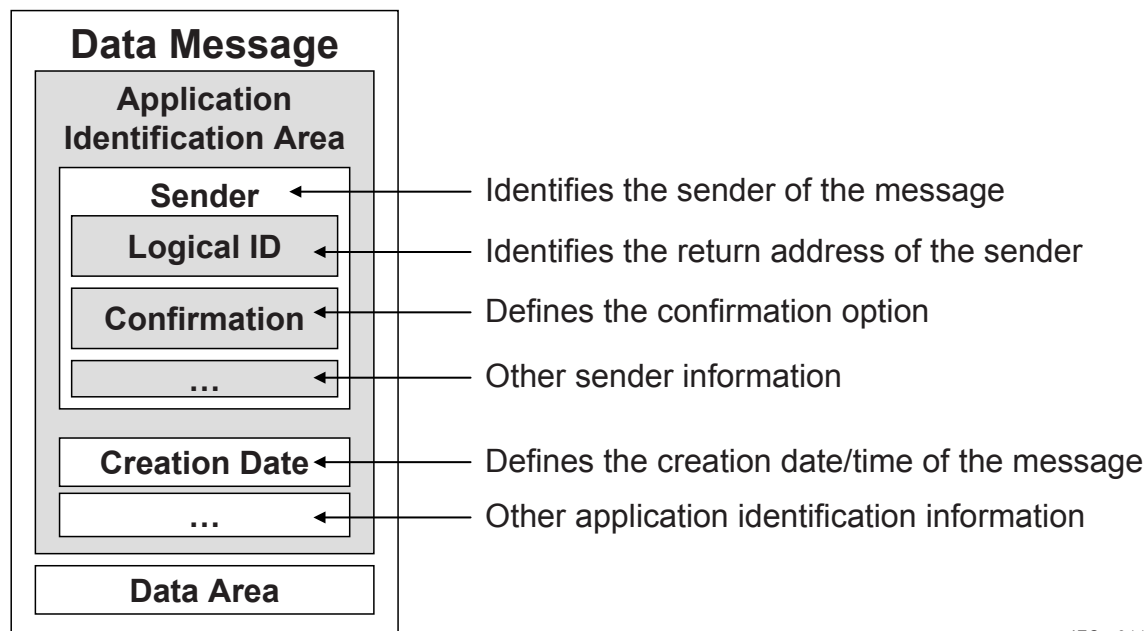


Figure 3 – Typical layout of an application identification area

4.3.3 Data area

The data area in a message shall contain a verb area and a noun area.

The verb area shall contain a verb and associated elements that represent the actions to be performed by the receiving application, or the response to a request by the sending application. The verbs defined in this standard are listed in Clause 5.

The noun area shall contain one or more nouns and associated elements. Each noun represents one or more objects defined in the IEC 62264-1 and IEC 62264-2 object models. The nouns defined in this standard are listed in Clause 6.

The verb-noun combinations define messages that have a unique and unambiguous meaning.

4.3.4 Message nouns

Nouns represent one or more instances of objects from the object models defined in IEC 62264-1 and IEC 62264-2 that have been grouped together for use with messages.

Example: A *Material Definition* noun is a composition of a *Material Definition* object instance with its *Material Definition Property* object instances.

4.3.5 Wildcard

The noun may contain a wildcard to identify multiple objects.

NOTE 1 Wildcards apply to the ID of a property, not to the value of the properties.

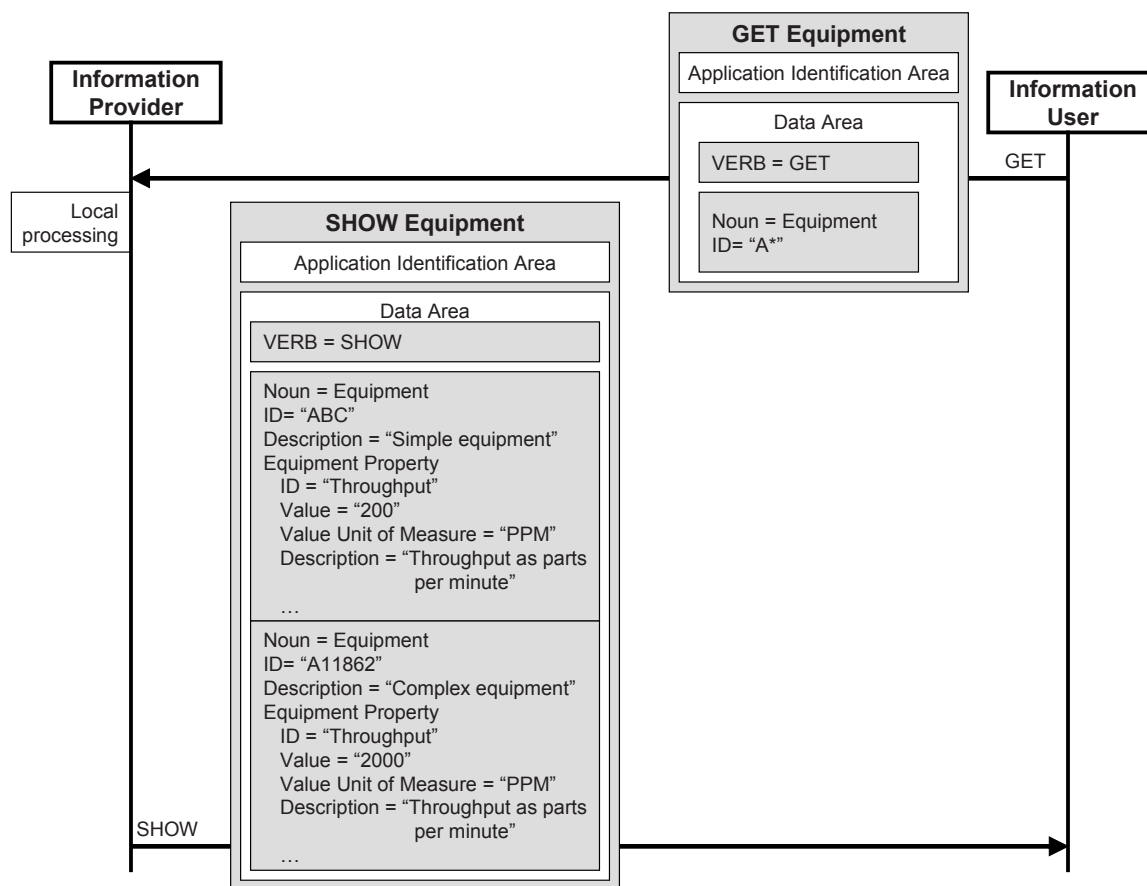
NOTE 2 Wildcards should be used with care if combined with lists of object IDs or property IDs. In the case of errors a confirmation message may not have sufficient information to determine the exact error.

NOTE 3 Conventionally wildcards in text strings are specified as regular expressions or limited regular expressions. In a limited regular expression a wildcard value can have the following special characters:

- "*" – Indicates zero or more characters, any character is acceptable.
Example 1: The wildcard "ABC*" would match "ABC", "ABCD", "ABCDEF", "ABC@4!*", but not "ABDDEF".
- "%" – Indicates one or more characters, any character is acceptable.
Example 2: The wildcard "ABC%" would match "ABCD", "ABCDEF", "ABC^4^*", but not "ABC".
- "?" – Indicates zero or one characters at the specified position, any character is acceptable.
Example 3: The wildcard "ABC?" would match "ABCX", "ABCD", "ABC!", "ABC", but not "ABCDE" or "ABDC".
- The character following a "\" is considered a literal character, not a wildcard character.
Example 4: An object ID of "ABC\"*" defines the object ID as "ABC*".
Example 5: A property ID of "\\USM 123" defines the property ID "\\USM 123".

NOTE 4 Two consecutive backslash characters, i.e. "\\" are interpreted to be a single backslash character "\".

Figure 4 illustrates a GET/SHOW transaction with a wildcard specified. The provider of the information returns a list of objects matching the wildcard specification.



IEC 312/11

Figure 4 – GET with wildcard and SHOW response

5 Message verbs

5.1 Verbs and transaction models

The verb area of a message shall contain a verb, defined in this clause and listed in Table 1.

Table 1 – Defined verbs

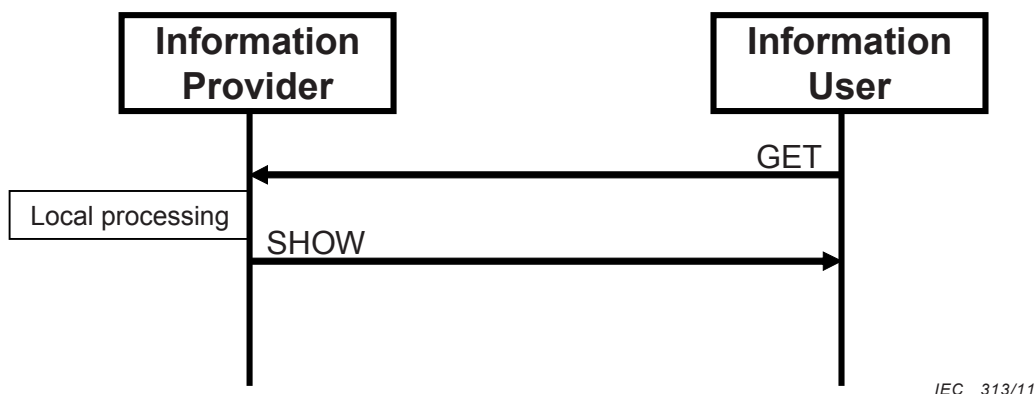
Verb	Description	Transaction Model
ACKNOWLEDGE	Acknowledgement of a PROCESS request. The noun may contain assigned IDs and other information to inform the sender of the PROCESS message of the IDs of any created objects. Example: A PROCESS message sent with a Material Lot may return the ID assigned to the lot by the receiving system.	PUSH
CANCEL	Request to a receiver to remove information. The specified noun shall be cancelled. If contained element IDs are specified, then only the specified contained elements for the specified noun shall be cancelled, not the noun. NOTE Not all objects have contained elements. Examples of contained elements are properties, specifications, actuals, etc.	PUSH
CHANGE	Request to a receiver to change information. The specified attributes and contained elements of the noun shall be changed. If no IDs of contained elements are specified, only the specified attributes shall be changed.	PUSH
CONFIRM	Confirmation response to a request.	PUSH, PULL, PUBLISH
GET	Request to a receiver for information on one or more objects. The receiver shall return a SHOW message containing all the specified attributes and all the specified contained elements of the specified nouns. If no attribute or contained element is specified in the noun area, then all attributes and/or contained elements shall be returned. When wildcards are applied to the noun and property IDs, it shall be possible to further filter the information to be returned by specifying a value for one or more attributes of the noun. Only objects whose attributes match the specified value (out of the list of objects matching the wildcards applied to noun and property IDs) shall be returned. Example: To get all the Material Lots with <i>Status</i> = "New", the wildcard "*" would be specified for the Material Lot ID and the "New" value would be specified for the <i>Status</i> attribute.	PULL
PROCESS	Request to a receiver to process new information. A new noun shall be added. If the specified noun already exists, only the specified contained elements shall be added.	PUSH

Verb	Description	Transaction Model
RESPOND	Response to a CHANGE message request. The noun may contain proposed or alternate information that was used in place of the CHANGE noun information. Example: A CHANGE message sent with an updated Material Lot status of "OK" may return a RESPOND with a different status of "OUT OF SPEC" because of business rules in the receiver of the CHANGE message.	PUSH
SHOW	Response to a GET message.	PULL
SYNC ADD	Request from the owner of the object to add information. A new noun shall be added. If the specified noun already exists, only the specified contained elements shall be added.	PUBLISH
SYNC CHANGE	Request from the owner of the object to change information. The specified attributes and contained elements of the noun shall be changed. If no IDs of contained elements are specified, only the specified attributes shall be changed.	PUBLISH
SYNC DELETE	Request from the owner of the object to delete information. The specified noun shall be cancelled. If contained element IDs are specified, then only the specified contained elements for the specified noun shall be cancelled.	PUBLISH
NOTE 1 Although this standard defines the transactions and messages, this standard does not specify how the associated activities are to occur. NOTE 2 The mechanism to set up the one-to-one association of the PUSH model is not included in this standard. Configuration and setup are implementation specific and would be defined in conforming specifications. NOTE 3 The mechanism to set up the one-to-one association of the PULL model is not included in this standard. Configuration and setup are implementation specific and would be defined in conforming specifications. NOTE 4 The mechanism used for subscribing in the PUBLISH model is not included in this standard. Subscribing mechanisms are implementation specific and would be defined in conforming specifications. NOTE 5 Contained elements are object properties or other contained elements as described in 6.2. NOTE 6 Different methods are possible to specify objects. Such methods depend on the specific noun as well as on the specific verb used, and are specified in the clauses for each object type. NOTE 7 The entity receiving the PROCESS message may perform further processing of the added information. NOTE 8 There is no ability defined in this standard to add or remove object attributes; IEC 62264-2 defines the object attributes. NOTE 9 Additional information returned in a SHOW message (as a response to a GET message) (e.g. IDs of referenced objects) is specified in the clauses for each object type. NOTE 10 Additional information changed by the CHANGE and SYNC CHANGE messages (e.g. IDs of referenced objects) is specified in the clauses for each object type. NOTE 11 Objects can be specified by specific values of their ID or by using wildcards.		

5.2 GET verb

The GET verb shall be used in a GET message to communicate a request for information on an object or list of objects.

The response to the GET message is a SHOW message.

**Figure 5 – GET and SHOW transaction**

The GET is designed to retrieve one or more objects and any contained objects by using ID attributes.

Within a GET message, the ID of the requested object is passed to the provider of the information. Where a single ID is not sufficient identification, for example when a property of an object is needed, then the ID of the encapsulating object, and the ID or value of the encapsulated object (the property) is passed to the provider of the data. The identifying IDs are specified in the clauses for each object type.

When a wildcard definition is used in the ID, then the GET returns a list of objects matching the wildcard specification.

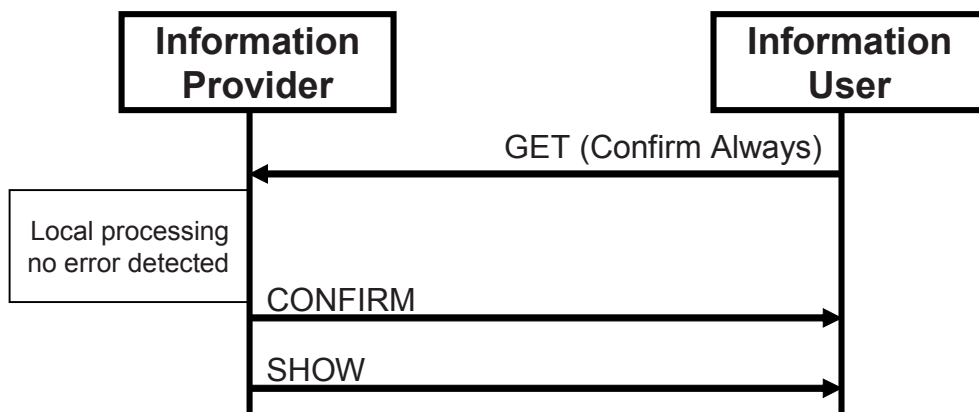
Example: GET may retrieve multiple objects such as all of the personnel classes.

NOTE GET with a wildcard provides a very limited query capability. The transactions are not intended to provide a complete query/reporting capability as normally seen in a database system. If additional query capability is needed, then the GET/SHOW transaction can be used to create copies of all data, and then that copy can be queried locally.

5.3 SHOW verb

The SHOW verb shall be used in a SHOW message when responding to a GET message.

Figure 6 illustrates a transaction with a GET message followed by a SHOW message and a CONFIRM message (because the “Confirm Always” option is specified with the example GET message).



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NOTE The order of arrival of the CONFIRM message, SHOW message, and any another response message is not defined in this standard.

Figure 6 – GET and SHOW transaction with a CONFIRM always

5.4 PROCESS verb

The PROCESS verb shall be used in a PROCESS message to request processing of the associated noun by the receiving application. A PROCESS message is sent to an entity that can process the object. In a typical exchange scenario a PROCESS message is considered to be the equivalent of a formal command. If the specified noun already exists, only the specified contained elements shall be added and processed.

NOTE A PROCESS verb is often the equivalent of a command to add an object, but usually the receiving entity does further processing of the information.

Example 1: The sending of a *PROCESS Production Schedule* message to a site indicates that the schedule is to be executed.

Example 2: The sending of a *PROCESS Equipment* message indicates that a new equipment item is to be added.

A PROCESS verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 2). If the optional element is not specified, then it defaults to Never.

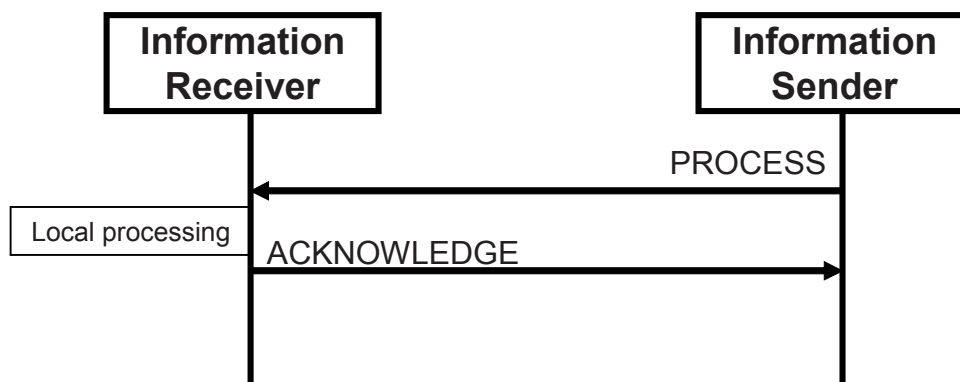
Table 2 – Acknowledge request options

Name	Description
Never	
Always	Always send an ACKNOWLEDGE message.

5.5 ACKNOWLEDGE verb

The ACKNOWLEDGE verb shall be used in an ACKNOWLEDGE message to indicate an application's receipt of a PROCESS request. The response to a PROCESS message is an ACKNOWLEDGE message. The ACKNOWLEDGE message may return the original or modified data. Figure 7 illustrates a PROCESS message with a response ACKNOWLEDGE message.

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Example: Sending of an *ACKNOWLEDGE Production Schedule* message, where a *PROCESS Production Schedule* message has been received and the corresponding business application acknowledges the receipt of the Production Schedule and responds with an acceptance.

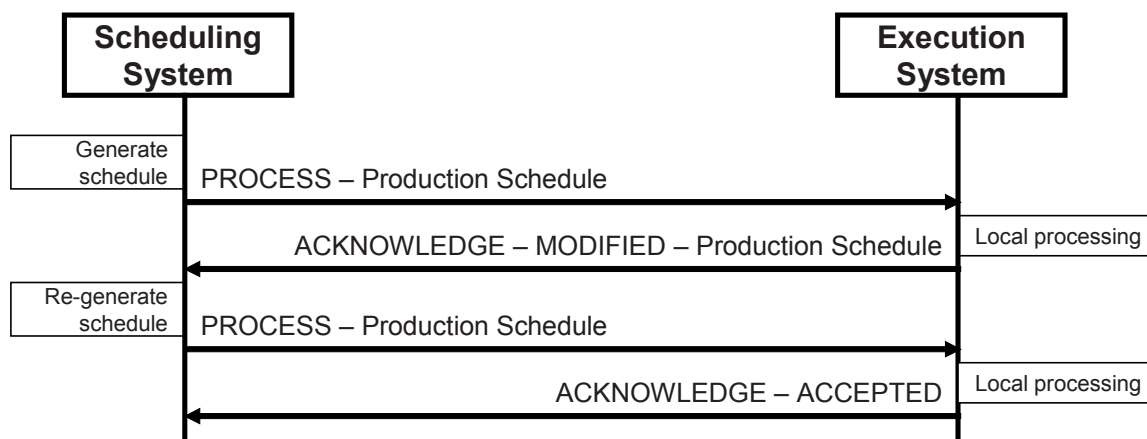
Figure 7 – PROCESS/ACKNOWLEDGE transaction

An *ACKNOWLEDGE* verb area contains an element with one of the following additional definitions: Accepted, Rejected, or Modified, (see Table 3).

Table 3 – Acknowledge element

ACKNOWLEDGE ELEMENT	DEFINITION
ACCEPTED	The information was accepted by the receiver of the information and was processed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not processed by the receiver. The message data area shall contain an
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing, the modified data shall be returned with <i>ACKNOWLEDGE</i> . The message data area shall contain an identification of the type of modification.

Example: Figure 8 shows a message sequence from a scheduling system to an execution system. The initial *PROCESS* message with a production schedule is received and an *ACKNOWLEDGE* message with a *MODIFIED* flag was returned with a new proposed schedule. The scheduling system re-generates a schedule and resends it to the execution system. The execution system accepts the production schedule and returns an *ACKNOWLEDGE* message with an *ACCEPTED* flag.



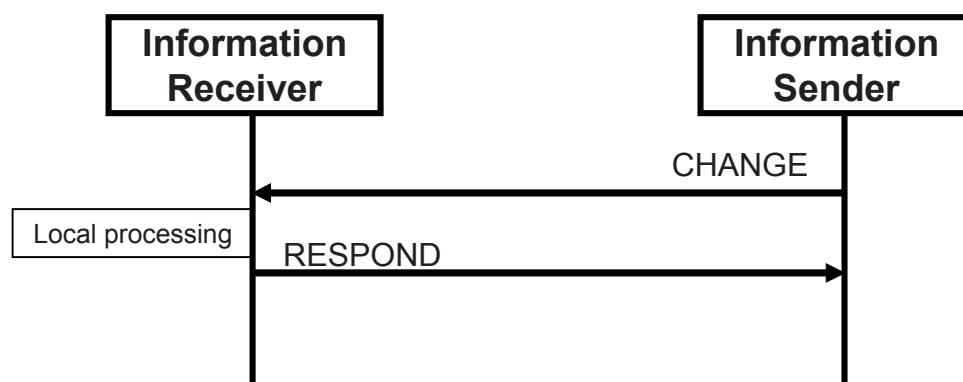
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Figure 8 – Example of ACKNOWLEDGE to a process message

5.6 CHANGE verb

The CHANGE verb shall be used in a CHANGE message when the sender of the message is sending a request for the data to be changed. The noun area contains the new data. Figure 9 illustrates a CHANGE message with a RESPOND message.

Example: Sending of a *CHANGE Person* message, where the personnel information, such as a qualification test, is changed by a system that is not the owner of the personnel model data.



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Figure 9 – CHANGE/RESPOND transaction

A CHANGE verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 4). If the optional element is not specified, then it defaults to Never.

Table 4 – Respond options

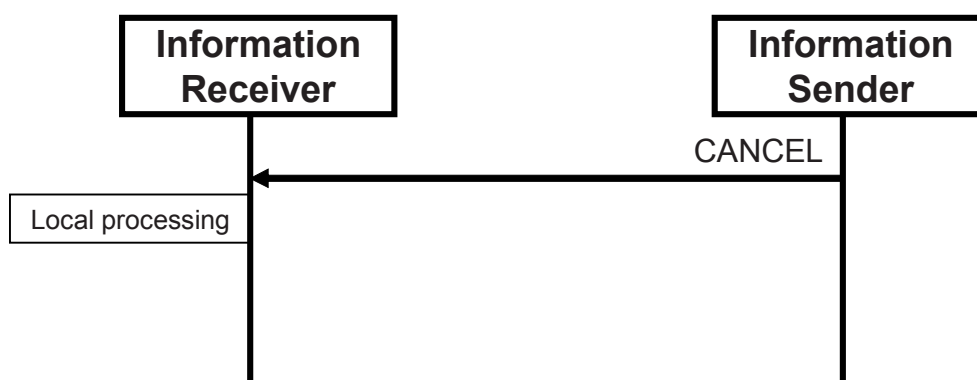
Name	Description
Never	
Always	Always send a RESPOND message.

5.7 CANCEL verb

The CANCEL verb shall be used in a CANCEL message when the sender of the CANCEL message is sending a request for the data to be cancelled.

Example: Sending of a *CANCEL MaterialLot* message, where an application indicates that a material lot is no longer valid (or available), but the application that is sending the CANCEL message is not the owner of the material model data.

NOTE Because the CANCEL is not sent by the owner of the data, the data are not necessarily deleted. The sender is indicating that the sender no longer needs the data.



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Figure 10 – CANCEL message

5.8 CONFIRM verb

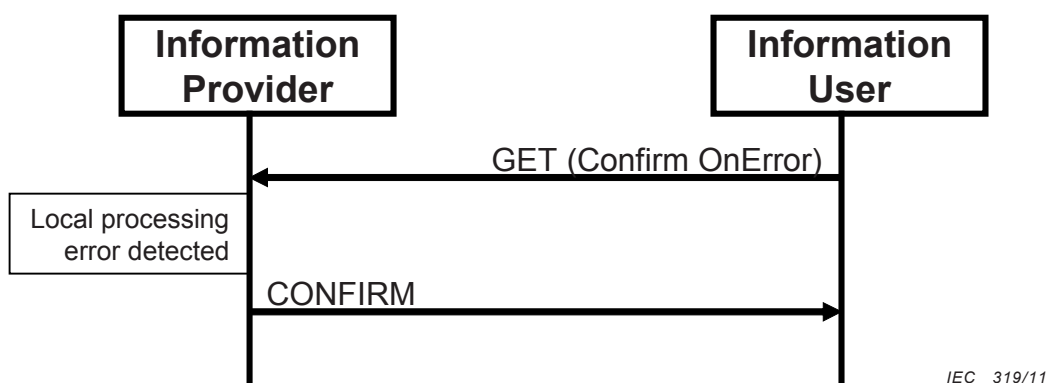
A CONFIRM verb shall be used in a CONFIRM message for confirmation of receipt and processing of any message other than the CONFIRM, RESPOND, or ACKNOWLEDGE messages. See Figure 11 for an example of confirmation with detected errors.

Confirmation is an option controlled by the sending business application. It is a request to the receiving application to send back a confirmation message to the sender of the initiating message.

A confirmation request, specified in the application identification area, has the values defined in Table 5.

Table 5 – Confirmation request options

Name	Description
Never	
OnError	
Always	Always send a confirmation regardless of the local processing.



NOTE The order of arrival of the CONFIRM message and any other response message is not defined in this standard.

Figure 11 – Example of a GET message with Confirm OnError

The CONFIRM message:

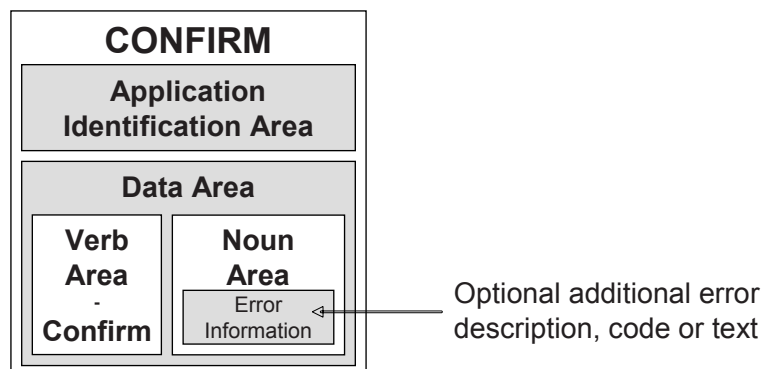
- Identifies the initiating message being confirmed.
- Indicates the status of the processing of the message.
- Includes a description of the error if the status indicates a processing error.

If an error occurs in the processing of the initiating message by the receiving application and the sender set the confirmation element to either *OnError* or *Always*, then the receiving application shall provide a CONFIRM message. If no confirmation option was specified, then the default value is *Confirm Never*.

Error handling at the application layer is provided through the confirmation element in the application identification area. Specific error codes or error text are not defined in this standard and are implementation specific.

The application error handling is in addition to any communication layer error handling that may be provided by the infrastructure framework, web service, or middleware.

An additional error description, code, or text associated with objects in the noun area may be contained in the noun area, as indicated in the Application Identification Area, as shown in Figure 12.



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Figure 12 – Confirm Message

5.9 RESPOND verb

The RESPOND verb shall be used in a RESPOND message to signify the application receipt and processing of a CHANGE message. The RESPOND message is used when responding to a CHANGE message. The RESPOND message may return the original or modified data.

A RESPOND verb area contains an element with one of the following additional definitions: Accepted, Rejected, or Modified (see Table 6).

Table 6 – Respond element

RESPOND ELEMENT	DEFINITION
ACCEPTED	The information was accepted by the receiver of the information and was changed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not changed by the receiver. The message data area shall contain an identification of the reason for rejection.
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing and the modified data were returned with the RESPOND. The message data area shall contain an identification of the type of modification.

5.10 SYNC verb

The SYNC verb shall be used in a SYNC message when the owner of the data is publishing the information or change in information to subscribers.

NOTE 1 SYNC is short for synchronize, and implies synchronized or aligned data; it does not mean synchronous communications.

NOTE 2 There should only be one application that sends SYNC messages for any specific element of information.

Example 1: A human resources system may provide personnel capability information; however, a training system may provide the Qualification Test Specification information pertaining to the personnel capability object.

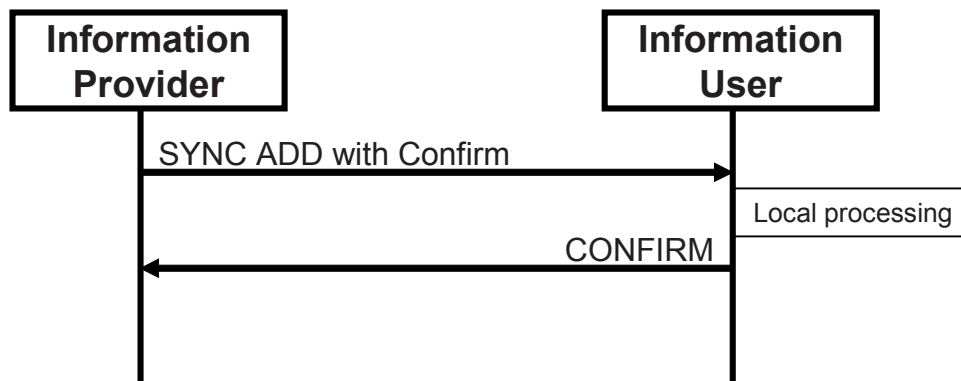
The owner of the information sends the SYNC message.

The SYNC message shall contain one of the following modifiers in the verb area: ADD, CHANGE, or DELETE.

Example 2: This verb is commonly used when mass changes are necessary, such as when an ERP publishes an item master to multiple MES systems, or when a publish and subscribe mechanism is used as a company's integration architecture.

5.11 SYNC ADD verb

A SYNC ADD verb shall be sent by the owner of the information and indicates that the owner of the information has added new information, as shown in Figure 13. The SYNC ADD message shall include the object instances added and the values of all attributes of these objects. The specific elements to be added are defined in Clause 6.



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Example: A SYNC ADD on a *QA TEST SPECIFICATION* object indicates the definition of a new QA Test Specification.

Figure 13 – SYNC ADD transaction with confirmation

5.12 SYNC CHANGE verb

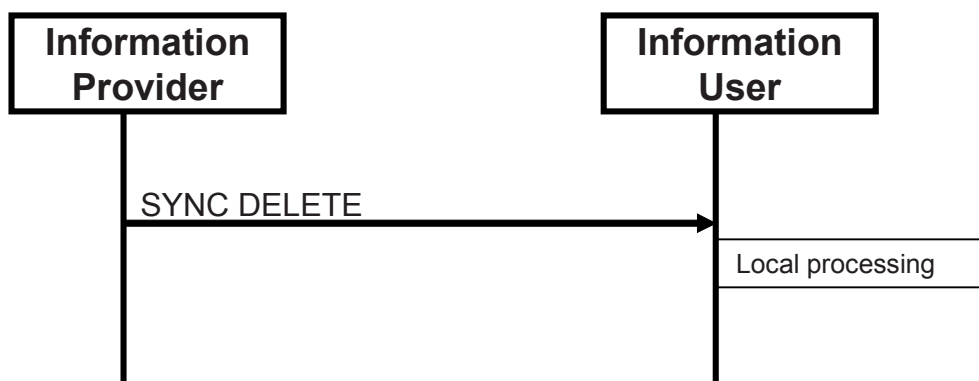
A SYNC CHANGE verb is sent by the owner of the information and is used to disseminate information on changed objects to subscribed users. The SYNC CHANGE message shall include the object instances changed with the values of the attributes changed. The specific elements to be changed are defined in Clause 6.

Example: A SYNC CHANGE message with a *MATERIAL CLASS* object indicates a change in the material class or a property of the material class and the new value.

5.13 SYNC DELETE verb

A SYNC DELETE verb is sent by the owner of the information and indicates that the provider of the information has deleted the information, as shown in Figure 14. The SYNC DELETE message shall include the object instances deleted. The specific elements to be deleted are defined in Clause 6.

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NOTE A SYNC DELETE message only indicates that the provider has deleted the information from publication. The information may still be archived or retained in accordance with business policies, but just not available for further publishing. The information user has the responsibility to determine the correct action, such as retaining or archiving their information.

Figure 14 – SYNC DELETE transaction with no confirmation

6 Message nouns

6.1 General

This clause defines the contents of the noun area in a message that shall be used by verbs to identify information exchanged.

6.2 Defined message contents

6.2.1 Transaction service profile

The message contents of a transaction service profile returns all supported verb/noun combinations, if the combination is supported as a receiver, if it is supported as a sender, and if wildcards are supported. See 6.12 and Clause 7 for the definition of the object and compliance information.

NOTE The transaction service profile is a method to interactively determine what verbs and nouns are supported by an application.

6.2.2 Personnel class

The Personnel Class noun contains the following objects as defined in IEC 62264-2:

- Personnel Class
- Personnel Class Property

6.2.3 Person

The Person noun contains the following objects as defined in IEC 62264-2:

- Person
- Person Property
- Qualification Test Result

6.2.4 Qualification test specification

The Qualification Test Specification noun contains the following object as defined in IEC 62264-2:

- Qualification Test Specification

6.2.5 Equipment class

The Equipment Class noun contains the following objects as defined in IEC 62264-2:

- Equipment Class
- Equipment Class Property

6.2.6 Equipment

The Equipment noun contains the following objects as defined in IEC 62264-2:

- Equipment
- Equipment Property
- Equipment Capability Test Result

6.2.7 Equipment capability test specification

The Equipment Capability Test Specification noun contains the following object as defined in IEC 62264-2:

- Equipment Capability Test Specification

6.2.8 Maintenance request

The Maintenance Request noun contains the following object as defined in IEC 62264-2:

- Maintenance Request

6.2.9 Maintenance work order

The Maintenance Work Order noun contains the following object as defined in IEC 62264-2:

- Maintenance Work Order

6.2.10 Maintenance response

The Maintenance Response noun contains the following object as defined in IEC 62264-2:

- Maintenance Response

6.2.11 Material class

The Material Class noun contains the following objects as defined in IEC 62264-2:

- Material Class
- Material Class Property

6.2.12 Material definition

The Material Definition noun contains the following objects as defined in IEC 62264-2:

- Material Definition
- Material Definition Property

6.2.13 Material lot

The Material Lot noun contains the following objects as defined in IEC 62264-2:

- Material Lot
- Material Lot Property
- QA Test Result

6.2.14 Material subplot

The Material Sublot noun contains the following objects as defined in IEC 62264-2:

- Material Sublot
- Material Sublot Property
- QA Test Result

NOTE In IEC 62264-1 and IEC 62264-2, material sublots do not have unique properties or quality test results. Implementation of this model should allow material sublots to have unique properties and quality test results.

Example: Sublot specific properties may be unique RFIDs (Radio Frequency ID) for each subplot or maximum temperature indicators for each subplot.

6.2.15 QA test Specification

The QA Test Specification noun contains the following object as defined in IEC 62264-2:

- QA Test Specification

6.2.16 Process segment

The Process Segment noun contains the following objects as defined in IEC 62264-2:

- Process Segment
- Process Segment Parameter
- Personnel Segment Specification
- Equipment Segment Specification
- Material Segment Specification
- Process Segment Dependency
- Personnel Segment Specification Property
- Equipment Segment Specification Property
- Material Segment Specification Property

6.2.17 Production capability

The Production Capability noun contains the following objects as defined in IEC 62264-2:

- Production Capability
- Personnel Capability
- Equipment Capability
- Material Capability
- Process Segment Capability
- Personnel Capability Property
- Equipment Capability Property
- Material Capability Property

6.2.18 Product definition

The Product Definition noun contains the following objects as defined in IEC 62264-2:

- Product Definition
- Product Segment
- Product Segment Dependency
- Manufacturing Bill

- Product Parameter
- Personnel Specification
- Equipment Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Material Specification Property

6.2.19 Production schedule

The Production Schedule noun contains the following objects as defined in IEC 62264-2:

- Production Schedule
- Production Request
- Segment Requirement
- Requested Segment Response
- Production Parameter
- Personnel Requirement
- Equipment Requirement
- Material Produced Requirement
- Material Consumed Requirement
- Consumable Expected
- Personnel Requirement Property
- Equipment Requirement Property
- Material Produced Requirement Property
- Material Consumed Requirement Property
- Consumable Expected Property

6.2.20 Production performance

The Production Performance noun contains the following objects as defined in IEC 62264-2:

- Production Performance
- Production Response
- Segment Response
- Production Data
- Personnel Actual
- Equipment Actual
- Material Produced Actual
- Material Consumed Actual
- Consumable Actual
- Personnel Actual Property
- Equipment Actual Property
- Material Produced Actual Property
- Material Consumed Actual Property
- Consumable Actual Property

6.3 Personnel model

6.3.1 Personnel model elements

The message definitions assume that information may be accessed from any of three starting points: personnel class, person, or qualification test, as identified by the dotted collections in Figure 15.

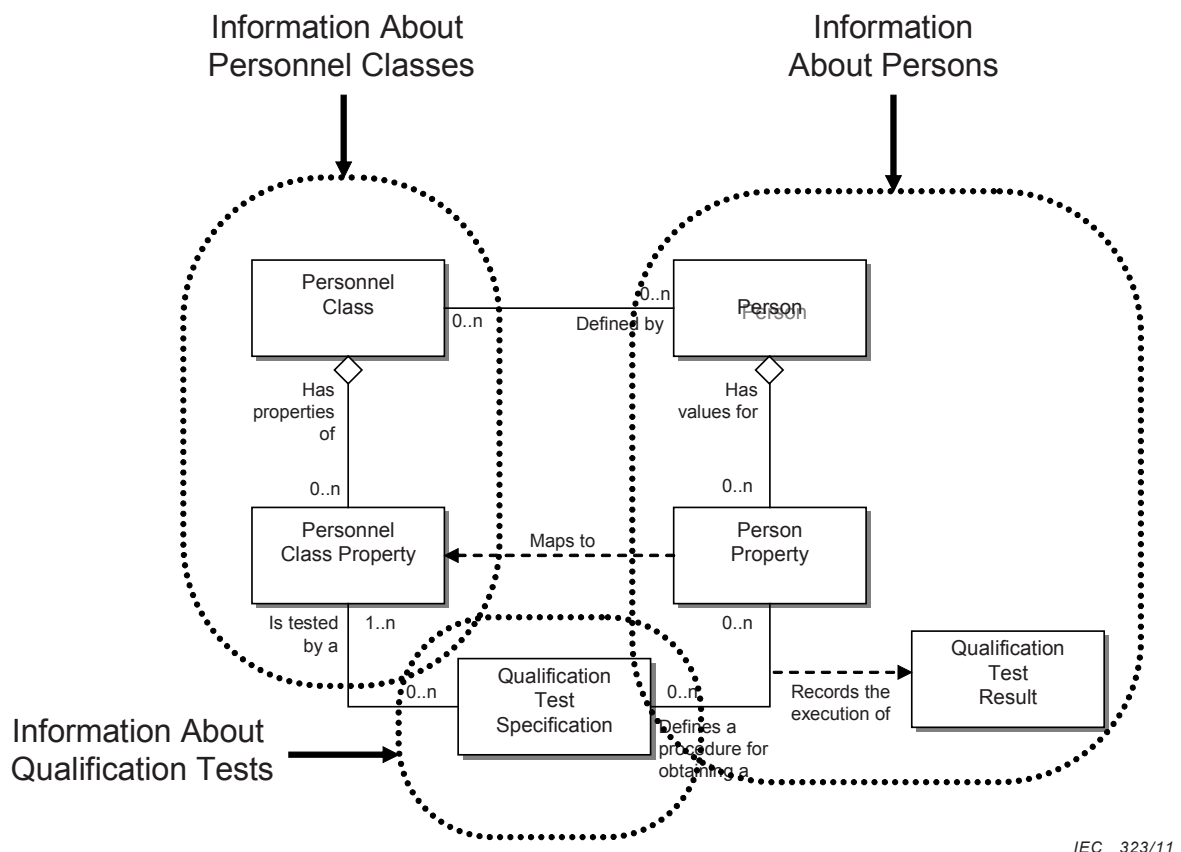


Figure 15 – Object grouping for the personnel model

Example: Messages may be: Get Personnel Class, Get Person, Get Qualification Test

6.3.2 Personnel class verbs

All verbs shall be valid for a personnel class noun.

A personnel class message contains information about personnel classes, or personnel classes and their personnel class properties. The returned information does not contain the person objects associated with the personnel class, but contains the IDs of the persons belonging to the class.

6.3.3 Personnel class verb actions

Table 7 defines verb actions and the use of IDs and values for the personnel class.

Table 7 – Personnel class verb actions

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property Value	Verb Action on Object(s) Specified
IDs specified	<i>not specified</i>	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified <i>Personnel Classes</i>, all properties and their attributes, and the list of <i>Person IDs</i> of the <i>Personnel Classes</i>. PROCESS: Shall define a request that the receiver is to add to <i>Personnel Classes</i>. The IDs define suggested IDs for the <i>Personnel Classes</i>. The receiver adds the <i>Personnel Classes</i> and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified <i>Personnel Classes</i> shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified <i>Personnel Classes</i>. SYNC ADD: Shall define a request that the receiver is to add the specified <i>Personnel Classes</i>. SYNC CHANGE: The specified attributes of the specified <i>Personnel Classes</i> shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified <i>Personnel Classes</i>.
IDs specified	IDs specified	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified <i>Personnel Classes</i>, all of the specified <i>Personnel Class</i> properties, and the list of <i>Person IDs</i> of the <i>Personnel Classes</i>. PROCESS: Shall define a request that the receiver is to add <i>Personnel Classes</i>. The ID defines suggested IDs for the <i>Personnel Classes</i> and a list of properties. The receiver adds the <i>Personnel Classes</i> and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified <i>Personnel Classes</i>. SYNC ADD: Shall define a request that the receiver is to add the <i>Personnel Classes</i> and a list of <i>Personnel Class Properties</i>. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of <i>Personnel Class</i> properties.